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NORTHERN JOHANNESBURG BRANCH ISSUE

•WORLD GREAT CIRCLE CHART•CENTRED ON JOHANNESBURG SOUTH AFRICA•
N.P
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REDAKTEUR:

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This edition of Radio ZS comes to you through the efforts of the Northern Johannesburg Branch members who have contributed the articles. Our thanks to all who contributed.

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COVER/VOORBLAD:

Great Circle Charts centred on Johannesburg by D.E.R. Londt ZS6BLV

The photograph which appeared on the cover of the last issue was taken by our President H.M. Wilson ZS1BF – Apoligies Ed.

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10th. September. 1970.

The Acting Editor,
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c/o P.O.Box 3911,
CAPE TOWN.

Dear Annie,

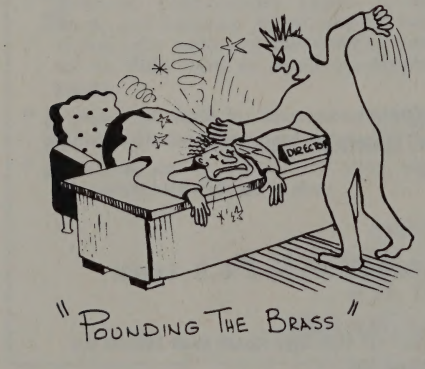
In view of the fact that our branch is involved in some way with the September issue of Radio-ZS the committee felt that they would like to make a further contribution to the production of this issue.

We therefore have pleasure in enclosing a cheque for R 50.00 which, although only a drop in the proverbial ocean of your expenses, may serve to lend some encouragement to your efforts.

Yours sincerely,

D.E.R.Londt. ZS6-BLV. Hon. Sec.

HAMTOON by D.E.R. Londt



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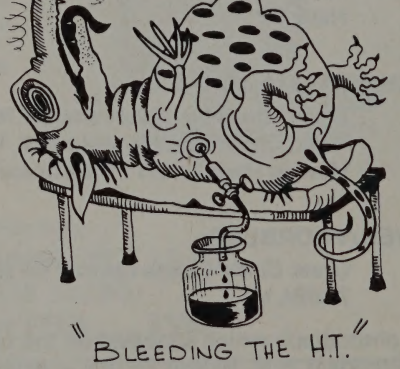

SMALL QUADS

by J. A. Verhoef
PAoCZ 1939
ZS6VJ 1967
PAoCZA 1968
ON8NM 1969

COMPACT ROTARY BEAMS

Good dx contacts can be made with a fixed horizontal half-wave or a vertical quarter-wave dipole. But for normal dx work on the 10, 15 and 20-meter bands the compact 3-element, 3-band trap Yagi rotary beam, mounted at perhaps 40 feet above the ground, has almost become the standard antenna. Aimed at the dx target its gain over a fixed dipole is at least 6 dB and it has 20 dB front-to-back discrimination. The average dx-er needs such performance. Can a 2-element, 3-band Cubical Quad equal these characteristics?

There are of course ambitious amateurs who want better-than-average dx performance and who experiment with large beams high above earth for a few hard-earned extra dB of gain. They battle with towers and booms.

For the same boom-length a multi-element Quad has 1 to 2 dB more gain than a multi-element Yagi. Large beam addicts like the Quad for this reason. However, the average dx-er who has acquired a rotator and is now considering the important step from dipole to small beam is more concerned with the question whether a Quad can give him the same performance as a trap-Yagi for less size, weight and expense.

The known data are as follows.

HORIZONTAL HALF-WAVE DIPOLE

Directivity gain over dipole O dB. Front-to-back ratio O dB. Impedance about 70 Ohms (300 Ohms for folded dipole).

VERTICAL FULL-WAVE LOOP
(Quad radiator).

Gain over dipole 1 dB. Front-to-back ratio O dB. Impedance over 100 Ohms.

2-ELEMENT YAGI

Gain over dipole 5 dB. Front-to-back ratio 15 dB. Impedance about 30 Ohms.

3-ELEMENT YAGI

Gain over dipole 6 dB (if compact) or 7 dB if more than 0.25 wavelength "deep". Front-to-back ratio 20 dB. Impedance from 10 to 30 Ohms.

2-ELEMENT CUBICAL QUAD

Gain over dipole 6 dB. Front-to-back ratio 20 dB. Impedance about 70 Ohms.

The gain figures are for antennas in free space, but in reality our antennas are mounted quite close to the more-or-less reflecting earth. For dx a compact beam will have a bit more than 6 dB advantage over a dipole mounted at the same height, because of its lower angle of radiation.

The curves of figure 1 were constructed from free-space vertical directivity patterns and earth-reflection diagrams. They are valid for perfectly reflecting earth. For horizontally polarised antennas they give a reasonable picture of reality.

Vertical half-wave dipoles theoretically have a radiation angle of zero degrees above perfectly reflecting earth. Unfortunately for vertically polarised waves the reflection of normal earth is very poor at our dx frequencies for small angles of incidence. Vertical dipoles have no advantage for dx work except if the antenna must be placed at a height of less than a quarter wavelength or over a very good earth (sea water). For our dx bands rotary arrays whose highest points are at least 30 feet above earth are better made with horizontal dipoles.

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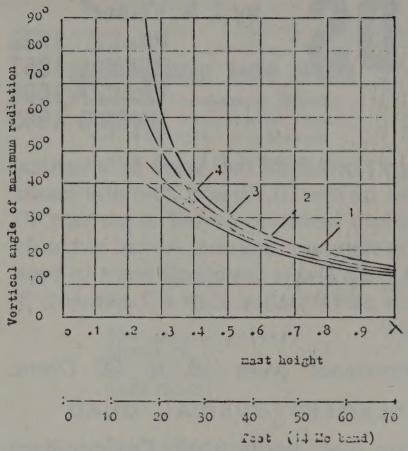


Figure 1

1 – Horizontal half-wave dipole
2 – Vertical full-wave loop (horizontal polarisation)
3 – Horizontal 2- or 3- element Yagi
4 – Horizontally polarised 2-element Cubical Quad

From the curves we note that for the same mast-height a Quad has a slightly lower radiation-angle than a compact Yagi, and a vertical full-wave loop is a little better than a dipole.

Our friend with his new rotator can make a very simple rotary with one 3-band (trap or multiple) dipole or with 3 concentric vertical loops (for 10,15 and 20 meters). The maximum dimension of a loop combination is only half that of a dipole so it can be made quite light and its performance (gain and radiation angle) is slightly better than of a rotary dipole for the same mast-height. Because it can be aimed at its target this is a much better antenna than a fixed dipole, but it would be even better to make either a 3-element trap Yagi or a 2-element concentric quad, and thus get 5 or 6 dB more gain and 20 dB front-to-back discrimination.

Let us compare these two alternatives in more detail.

YAGI AND QUAD

COMPACT 3-ELEMENT YAGI

Half-wave dipole radiator, $\frac{475}{f(Mc)}$ feet long, fed at its centre. Parasitic reflector dipole, $\frac{500}{f(Mc)}$ feet long, 0.15 wavelength behind radiator. Parasitic director dipole, $\frac{455}{f(Mc)}$ feet long, 0.1 wavelength ahead of radiator. Total depth 0.25 wavelength. Feed impedance about 10 Ohms. Gamma-match required with 50- or 70-Ohm coaxial feeder cable.

Radiator is cut substantially shorter than a half wavelength (which is $\frac{492}{f(Mc)}$ feet) because it is detuned by the capacity to ground of its free ends.

Full-size 3-element Yagi (gain 7 dB) is 0.35 wavelength deep and has 30 Ohms impedance.

2-ELEMENT CUBICAL QUAD

Full-wave vertical loop radiator, $\frac{1005}{f(Mc)}$ feet circumference, fed at its lower centre (for horizontal polarisation). Similar parasitic reflector, $\frac{1030}{f(Mc)}$ feet circumference, up to 0.2 wavelength behind radiator. Feed impedance about 70 Ohms (decreases with decreasing radiator-reflector spacing).

Proximity of ground has little influence on resonant frequencies. (Quad loop is even cut a little longer than one wavelength.)

Summarising, the gain of a 2-element Quad is the same as of a compact 3-element Yagi. When mounted close to the ground a Quad is not so easily detuned and maintains a slightly lower angle of maximum radiation. It is easier to make and adjust a 3-band Quad with concentric loops for 10, 15 and 20 meters than a 3-band Yagi with resonant traps. The largest dimension of a Quad is only half that of a Yagi so it can be made lighter.

The only disadvantage of a Quad is its clumsiness. Because of its third dimension it is difficult to manage on ground or roof with its wires and spreaders.

It may look exciting to Quad addicts but non-aligned spectators are not impressed by its beauty.

If only the Quad's size could be reduced, it would lose much of its disadvantage. Linear reduction of a three-dimensional structure has rather a drastic effect. For instance, a 14-Mc Quad with 0.2 wavelength spacing has an "air volume" of $17\frac{1}{2} \times 17\frac{1}{2} \times 13\frac{1}{2} =$ 4200 cubic feet and reduction of its elements to 75 per cent of normal and of the spacing to 0.18 wavelength would give $13 \times 13 \times 12\frac{1}{2} = 2100$ cubic feet! A "reduced" 3-band 2-element Quad would need no boom. Its 6 loops could be suspended from a boom-less spider structure. This could be made light and strong. A spider has the advantage that the radiator-reflector spacing, and thus also the feed impedance, can be made more nearly the same for all 3 bands in terms of wavelength.

Various reduction methods for the 14-Mc elements of a 3-band spider Quad were tried at ZS6VJ, PAoCZA and ON8NM.

SHORT QUAD

A Quad loop is not a loop aerial in the medium-wave sense. Like all standing-wave aerials it is a combination of half-wave dipoles. In figure 2 we see its standing-wave current distribution. It is the same as for a "stack" of two half-wave dipoles, one placed at one-quarter wavelength above the other, whose tips are bent together until they touch. As a radiator this combination is fed at the centre of a lower dipole, the top dipole thus being "tip-fed".

If we want to shorten the Quad loop we must fold away or crumple up the dipoles a bit more. The reduction of the size must cause some loss of directivity gain which we estimate as follows.

In a full-wave loop the vertical sides do not contribute to the dx radiation. The currents in them cancel each other, so the effective length of the two stacked dipoles is 0.25 wavelength.

In a reduced loop (80%) this effective dipole length (as well as the stacking height) is only 0.2 wavelength.

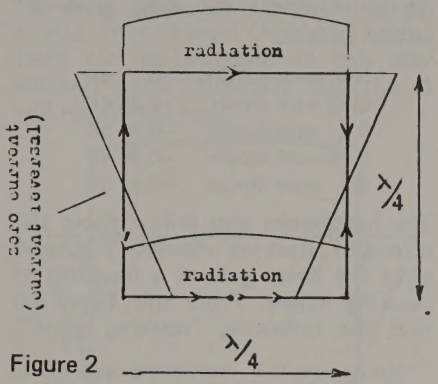


Figure 2

Standing wave current distribution in Quad loop.

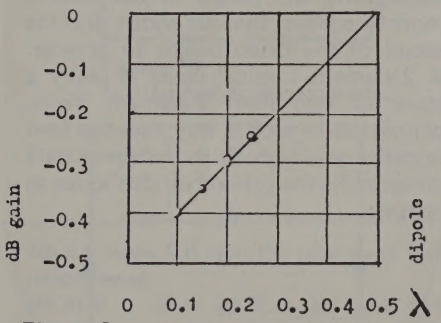


Figure 3

Gain of shortened dipoles (estimate)

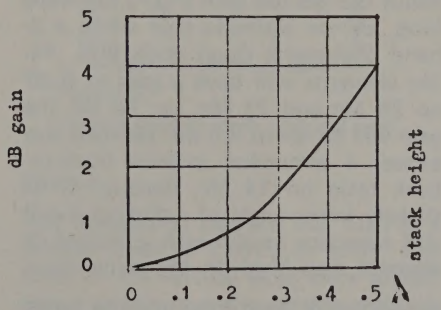


Figure 4

Extra gain from stacking

Now antenna handbooks tell us that the directivity gain of a very short (0.1 wavelength or less) dipole is only 0.4 dB less than a half-wave dipole. Making a bold interpolation (figure 3) we estimate the following gains or rather losses).

Half-wave dipole:	0 dB
0.25 wave dipole:	–0.25 dB
0.2 wave dipole:	–0.3 dB
0.15 wave dipole:	–0.35 dB
0.1 wave dipole:	–0.4 dB

The handbooks also tell us about the effect of stacking dipoles. Figure 4 gives the extra gain as a function of stacking height. From this figure we find the following "stacking gains".

Stack height 0.3	wavelength: gain 1.5 dB
0.25	wavelength: gain 1 dB
0.2	wavelength: gain 0.6 dB

Apparently the height of the loop is more important than its width, and the secret of the Quad begins to emerge. A 2-element Cubical Quad is really a stack of two short 2-element Yagis, connected in such a way that the feed impedance is high. With the above data we estimate the gain of various loops as follows.

Full wave loop	0.3 high	0.2 wide:	1.2 dB (over dipole)
Full wave loop	0.25 by	0.25	0.75 dB
80% loop	0.25 by	0.15	0.65 dB
80% loop	0.2 by	0.2	0.3 dB

Apparently a square 80% loop has about 0.5 dB less gain than a full-wave loop, so we estimate that while a 3-band 2-element Quad with 80% 14-Mc elements will have a gain of 6 dB on 28 Mc and 21 Mc, on 14 Mc the gain will be about 5.5 dB. We may also expect a somewhat inferior front-to-back ratio on 14 Mc. Because of its slightly lower angle of radiation it will still compare nicely with a 3-band 3-element trap Yagi on the same mast.

A shortened Quad loop must be tuned to its operating frequency, otherwise we can not feed it properly. Folds or coils must be introduced. In order to maintain the greatest possible directivity we must try to keep the current along the dipoles as constant as possible. To maintain the stacking effect both top and bottom dipoles must carry the same current. The currents in the vertical sides should cancel out. The tuning method with a single coil in the top horizontal (figure 5) would cause a great loss of symmetry for a reduction of 80%. We must try to do better.

The introduction of coils in the loops will cause their Q to increase. With tuning "folds" this may be less so.

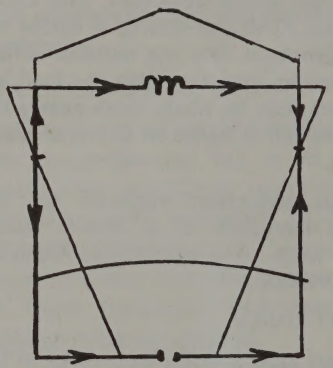


Figure 5
Single tuning coil.

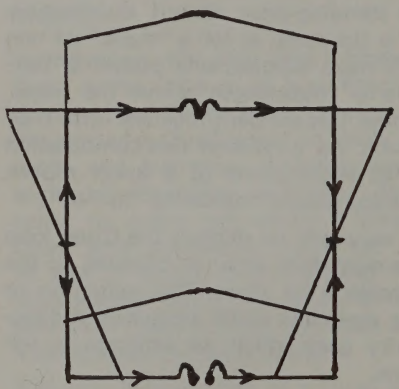


Figure 6A
Tuning coil at centre of each dipole.

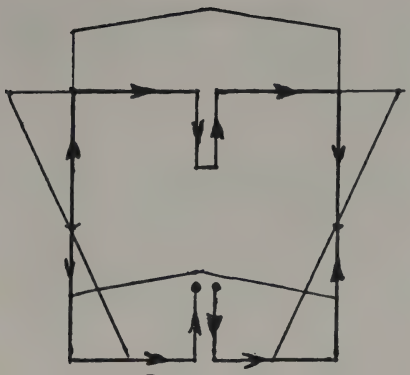


Figure 6B
Tuning fold at centre of each dipole.

Figure 6 shows coils or folds at the centre of both dipoles.

Figure 7 shows coils or folds at the corners. This gives a good current distribution, even though the currents in the legs of the folds do not quite cancel out. False radiation from the folds "eats away" some of the nice current distribution. With coils at the corners this false radiation will not exist, but the Q of the loop will be higher.

In a single-band Quad such corner folds can be arranged along the spreaders. In a 3-band Quad corner folds in the 14-Mc elements will be in the way of 21 Mc elements.

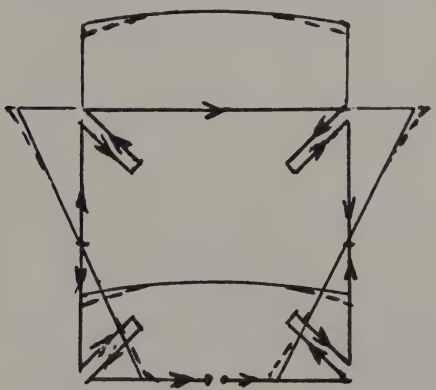


Figure 7A
Tuning fold at each corner.

How about tuning folds in the vertical sides of the loop? Figure 8 shows this possibility. Tuning coils have little or no effect at the points of current reversal. With this arrangement the false radiation from the folds is rather strong. In a 3-band Quad the tuning folds can be arranged in this way without much difficulty and the Q will not be too high.

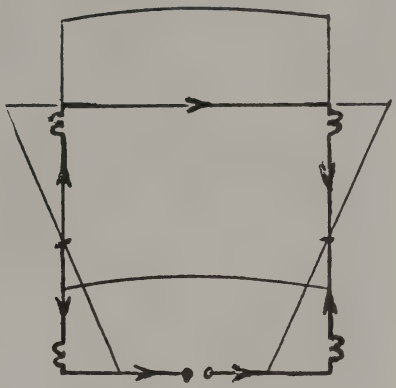


Figure 7B
Tuning coil at each corner.

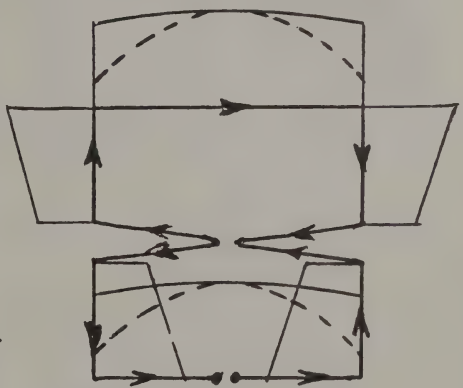


Figure 8
Tuning fold in each vertical side.

ZS6VJ

The method of figure 8 was used in a 3-band Quad at ZS6VJ in 1967. The folds in the vertical sides were spaced about one foot at the outside and supported each other through a single egg

☛

insulator at the centre. The total length of wire in the loops was found to correspond fairly well to the formula for a normal loop. Apparently the length of wire in the tuning folds was about 100% "effective".

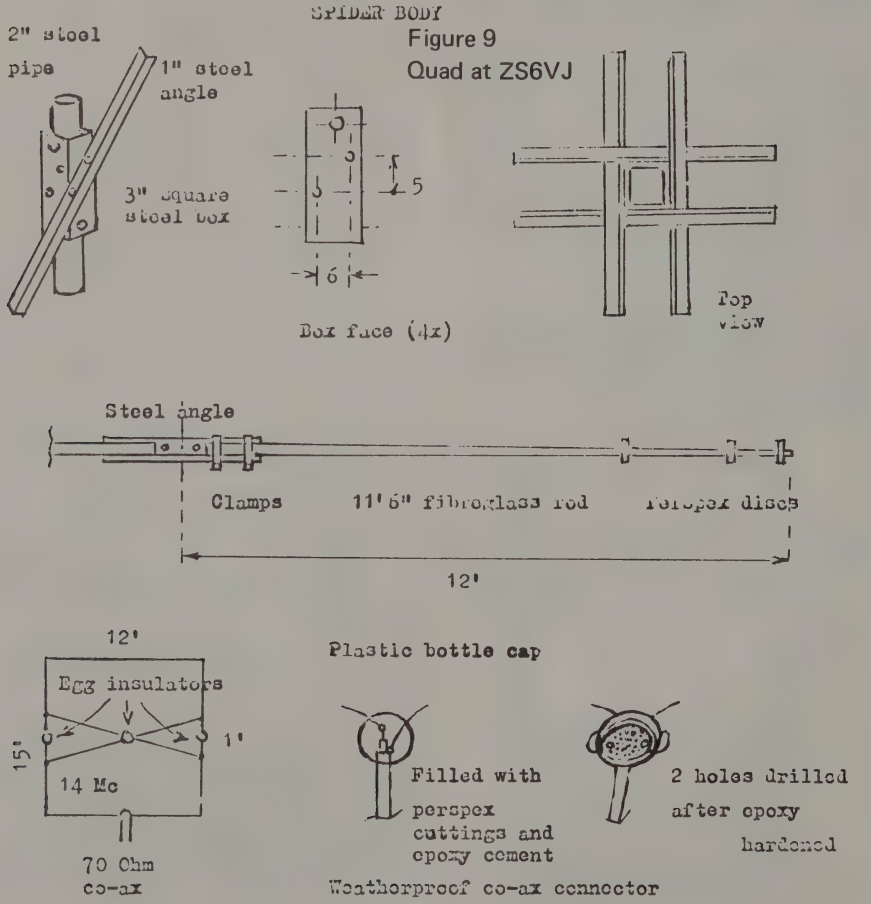
Figure 9 shows the hardware that was used. The spider spreaders are tapered fibre-glass rods (unfinished fishing rods) about 11½ feet long and tapering from about 1¼" diameter to ¼" diameter They support the elements almost without sagging and are ideal for the job.

The central spider body is a bit heavy but strong and simple. Its construction around the four faces of a square steel box section restricts the choice of spreader angles to wide spacing (about 0.22 wavelength for 28 and 21 Mc, and 0.18 wavelength for 14 Mc), and causes the loops to be slightly higher than wide.

Perspex discs (the largest about 2" diameter) were perforated to fit tightly on the tapered spreaders at the required distance from the tips. The stranded aerial wire is pulled through two small holes in each disc. The weatherproof cable connector is a plastic bottle cap, filled with perspex cuttings and cemented up with epoxy resin.

If accurate tuning is to be achieved, quite a few adjustments are necessary so it must be possible to raise and lower the antenna easily without help.

Figure 9
Quad at ZS6VJ



Rough adjustment is possible with a grid-dip meter, but the radiators must be tuned to resonance separately (all other elements being mounted in place but only the radiator under treatment connected to the feeder), by plotting the SWR across the band. The radiator length is adjusted until the point of minimum SWR is in the middle of the band. Once the correct length of the radiator is found it can be measured, and the reflector can be made $2\frac{1}{2}\%$ longer.

If the Quad is tuned correctly for each band, the radiators can be connected in parallel and this has little influence on the SWR.

For the ZS6VJ Quad the SWR was measured to be as shown in figure 10.

PAoCZA

Figure 11 is a sketch of the small one-band Quad used at PAoCZA in 1968 for daily skeds with South Africa on 21 Mc. At this QTH there was no space to raise the 3-band fishing-rod Quad so a new "boom-plus-windmills" frame was made from plastic plumbing pipe with a nylon rope brace. The boom was 3" and the spreaders were $1\frac{1}{4}$" pipe. The tuning method with corner folds was used (Figure 7A). The beam was small and light so it lasted well in spite of its flimsy construction.

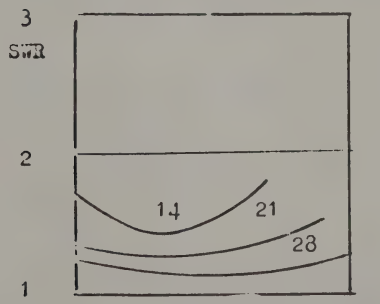


Figure 10
SWR of ZS6VJ Quad (fig. 8)

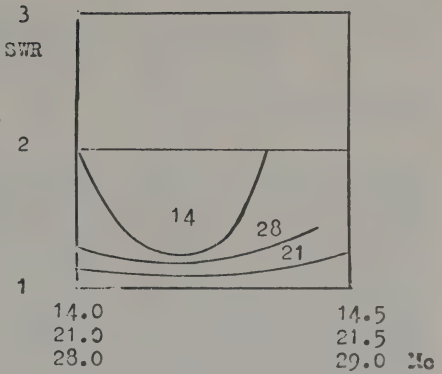


Figure 12
SWR of ON8NM Quad (fig. 7B)

With a grid-dip meter it was found that the total length of wire in the corner folds had to be 50% more than the missing length of loop it had to replace according to the formula. Apparently the wire length in these folds with $1\frac{1}{4}$" spacing in only 66% "effective". Once this was established, the radiator was made to resonate in the 21 Mc band, using SWR measurements and a tape measure. Finally the reflector was cut $2\frac{1}{2}\%$ longer ("effectively"), using only the tape measure. This mini-quad had an "air-volume" of only 9 x 9 x 9 = 730 cubic feet. The SWR at the centre of the band was 1.2 with 70 Ohm cable.

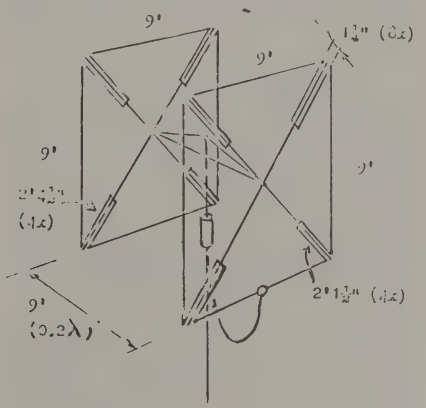


Figure 11
2-element Quad for 21 Mc
elements reduced to 75%

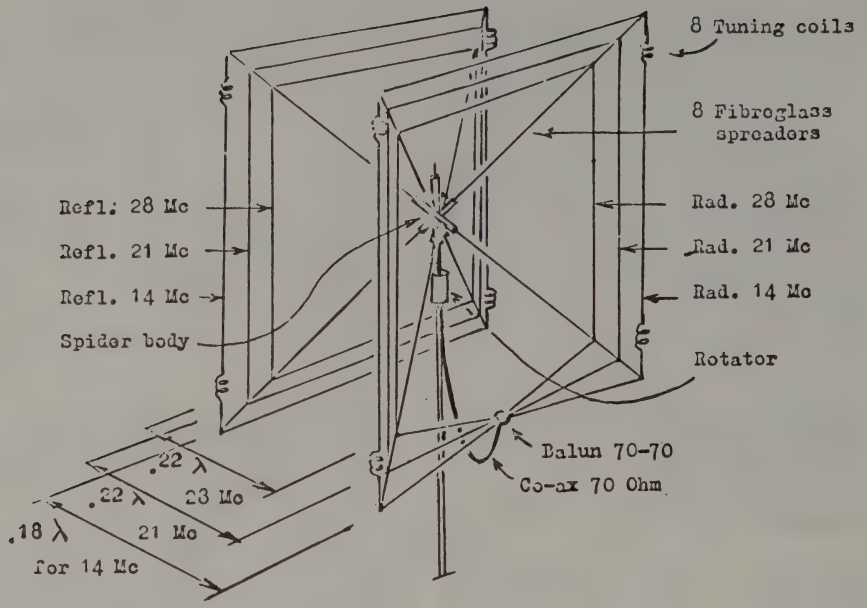


Figure 13 - Boom-less 3-band 2-element Quad with shortened 14-Mc elements

ON8NM

The fishing-rod spider Quad was reassembled at ON8NM. This time the tuning method of figure 7B was tried. At each corner an air coil, about 5" x 5", was connected across an insulator. The wire length in these coils was found to be 70% "effective". The missing length of 54" per corner in the radiator was replaced by 77" of wire per coil. A lot of inductance is introduced in this way, and the SWR measurements indicated that the Q was higher than with the folds used at ZS6VJ. This is shown in figure 12. The front-to-back ratio was not good. It is not yet clear whether this was due to the high Q of the reflector, inaccurate tuning of the reflector, or the nearness of the ground during this test (mast only 20').

CONCLUSION

Coil tuning looks attractive. Coils take little space and cause little false radiation. But so far the best results were obtained with folds in the loops. The best solution found for a single-band quad is the PAoCZA model. For a three-band Quad the ZS6VJ model, shown in figure 13, is the best so far.

Further tests will be done with the tuning methods of figure 6 and figure 7.

RADIO ZS

BRANCHES, MEMBERS AND ADVERTISERS

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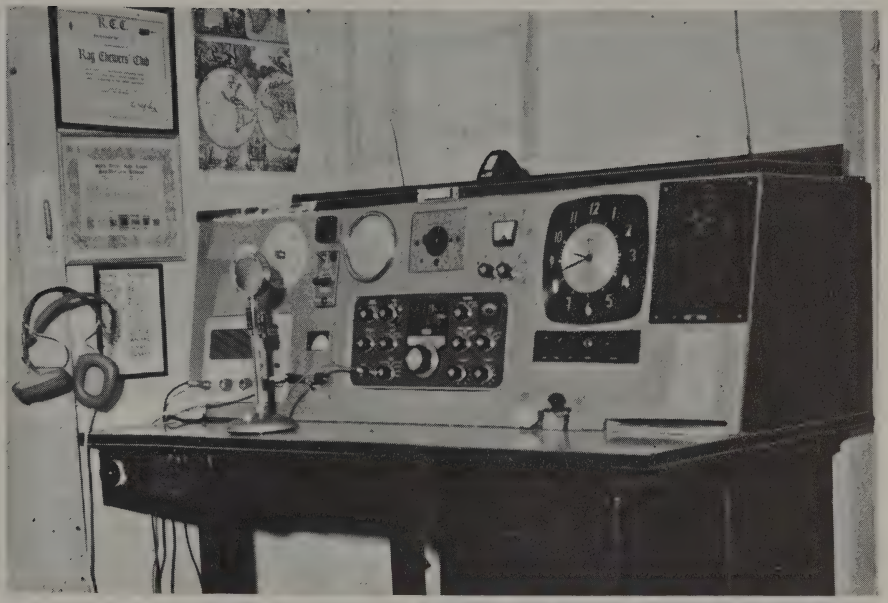
HAM IN A FLAT (SPIN)

by Sam Manne, ZS6-BBW



After many harsh words with the S.W. about the looks of the rig stationed in the entrance hall where it was always in a mess and always dusty, I decided to put it in a console to keep it clean.

This turned out to be very much easier than I expected. As you can see from the photographs it is merely a shelf with side supports and a pressed board front. The sides are not cut square but have a slope to make operating easier.

The most difficult part of the job is deciding where the various units should be placed for convenience of mounting and operating. I did this by making a cardboard template of each piece of equipment and moved them around on the panel to find the best position. Cutting out the holes can be difficult without an electric saw but it can be done. As I am not the best carpenter in the world the holes ended up with wavy lines and gaps all around the equipment so I wound plastic tape round each item and after it was mounted the gaps were filled with plastic wood. When this was dry the front panel was removed, sanded and sprayed.

As you can see, everything is in its place. Dust is no problem and the space behind the equipment is storage for test instruments which are only needed when you climb into the back.

The front panel should not be of masonite because everything is attached with screws and pressed board is ideal. As some of the switches and controls will not have long enough shafts to go through the panel they are mounted on aluminium panels which are screwed onto the front.

Since building this station all is now quiet on the home front. RADIO ZS

AMENDMENTS TO CALL BOOK NO. 22

*ZS1AU	Dennis Wells — delete — see ZS4AU
*ZS1BV	Ken Scott — Silent Key — Deceased.
*ZS1CZ	Harold Tronson — Silent Key — Deceased.
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*ZS1DN	D. F. Bierenbroodspot, 25 Myrtle Manor, White Rd, Rondebosch, C.P.
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*ZS2PA	George Papadrosses — Silent Key — Deceased.
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*ZS6ANZ	B. L. Bresler, 51 Frere Avenue, Discovery, Transvaal.
*ZS6ARE	A. J. (Pottie) Potgieter, P.O. Box 61574, Marshalltown, Transvaal.
*ZS6ASJ	John Geyer, 26 Cecil Street, Meredale, Johannesburg.
*ZS6AUD	Herman S. van Dijk, Avondrus 3, Posbus 887, Vereeniging, Transvaal.
*ZS6AXB	Ds. (Ollie) W. J. C. Olwagen, Parkstraat 108, Randfontein, Transvaal.
*ZS6BHD	John D. Freedman, 2 Camellia Road, Wynchwood, Germiston, Transvaal.
*ZS6BJR	Emil Hahn, 15 Barclays Circle, Hazeldene, Germiston, Transvaal.
*ZS6BLN	P. D. Neveling, 402 Jacgmar, Walker Street, Pretoria.
*ZS6CT	C. J. Engelbrecht, 50-14th Avenue, Boksburg North, Transvaal.
*ZS6GJ	Should read J. H. Bouwmann.
*ZS6NT	D. N. West, P.O. Box 1363, Vereeniging, Transvaal.
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*ZS6QD	Sammy de Beer, P.O. Box 157, Potchefstroom, Transvaal.
*ZS6SB	Karl Baumann — Silent Key — Deceased.
*ZS6TA	N. E. Pocock, P.O. Box 84, Kokstad, East Griqualand.
*ZS6UA	A. Donde, Union Radio Co. 60 Loveday Street, Johannesburg.

QSY Page 23

When Capacitors Are Not

submitted by M. W. Newman, ZS6-398

taken from "CQ" – Roger Taylor K9ALD

For many years circuits have appeared in publications and commercial equipment for the amateur in which .001 and .005 mf disc ceramic capacitors have been used as bypass and coupling capacitors. However, one fact that most engineers have overlooked is that with one quarter inch lead lengths, a .001 disc capacitor is self resonant at about 60mc, and a .005 mf disc capacitor is self resonant at about 20mc. This means that a .005 mf disc capacitor, when used as a bypass at 50mc, is really a nice large inductor. Its reactance MAY be small enough to allow some bypassing action, however, try removing one of these .005 capacitors from a VHF circuit and see how much gain is lost. It won't be much. (These same self resonant capacitors are responsible for many of the unsuspected parasitic oscillations which turn up in amateur equipment).

For high frequency use, a bypass capacitor should be self resonant slightly above the highest frequency to be used at that circuit. Exactly at the self resonant frequency of a capacitor, the impedance will be zero. To get the best bypass or coupling action, the capacitor should be chosen so that the zero impedance point falls near the particular frequency being used.

To find the self resonant frequency of a capacitor, solder the tips of the leads together and check it with a grid dip meter. Following is a table of resonant frequencies of various capacitors. These values will vary slightly with different manufacturers and voltage ratings, and they will vary considerably with lead lengths. The resonant frequency of a capacitor is an exponential function of lead lengths. So, at high frequencies keep them short!

RESONANT FREQUENCIES OF TYPICAL BYPASS CAPACITORS

$\frac{1}{2}$" X $\frac{1}{4}$" MICAS mmf	Resonant Frequency
47	206 mc
100	154 mc
270	990 mc
390	70 mc
470	60 mc
560	50 mc

DISC CERAMICS mf	Resonant Frequency
0.001	60 mc
0.002	40 mc
0.005	23 mc
0.01	15 mc
0.02	9 mc
0.1	4.2 mc

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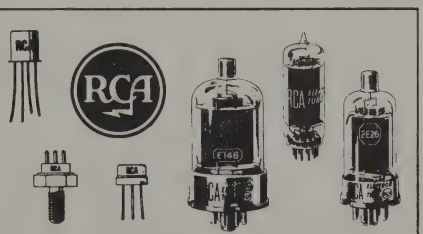

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GREAT CIRCLE CHARTS

by D. E. R. Londt, ZS6-BLV.

Every self-respecting Ham will at some stage develop the desire to adorn his shack with a great circle map of the world showing his true bearing and distance to any point on the earth's surface, a feature which cannot be had from the Mercator projection commonly obtainable.

Just such a desire gripped me early in 1969 and after some enquiries it became apparent that such maps are extremely difficult if not impossible to obtain. It was therefore decided to undertake the task of preparing my own map centred on Johannesburg. This can be tackled in a number of ways. For example one could decide to plot all latitude and longitude intersection points at say 10 degree intervals, filling in the continental boundaries by hand. Or one could plot a suitable number of world city locations and once again approximate to the outlines of the countries. The latter approach was selected as incurring less work.

A scale of 1 inch to 1000 miles was chosen and a series of concentric circles, representing multiples of 1000 miles from Johannesburg were drawn in. The outermost circle will fall at an odd distance of 180 x 69,057 = 12,430 miles, which in this type of projection represents a point on the earth antipodal to the point of origin. Beyond the outer circle a 360 degree scale is set out from which the bearing angle to the desired point can be read. This should be marked in convenient divisions with zero degrees due north and progressing in a clockwise direction around the scale. The point co-ordinates, which should all be calculated before any layout begins, can then be plotted. By referring to a good atlas the outline of land masses can be set down with fair accuracy. This can be made easier by ensuring that a good proportion of the towns plotted fall on or near coastlines.

The final result was extremely pleasing from the point of view of both appearance and personal satisfaction. For those enterprising enough to have a bash at cartography, the following formulae can be used. I have included some rules for sorting out the mass of figures resulting from this type of calculation. These are for the distance calculations. The reader will no doubt be able to formulate similar ones when dealing with bearings. The assistance of a globe in this case would help in determining which result is correct. With trigonometric functions there are always a number of angles satisfying one answer.

ORIGIN CO-ORDINATES:

Longitude: Xo^o (East for Johannesburg)
Latitude: Yo^o (South for Johannesburg)

REQUIRED CO-ORDINATES:

Longitude: Xp
Latitude: Yp
} o (of point to be plotted)

LONGITUDE DIFFERENCE:

$X = Xp + Xo$ (for points West)
$X = Xp - Xo$ (for points East)
} degrees

A. GREAT CIRCLE INTERNAL ANGLE: (Z degrees)

$A = CosX\ CosYo\ CosYp$
$B = SinYo\ SinYp$

POINTS OPPOSITE SIDES OF EQUATOR:

$X \leq 90^o$ { $Yo + Yp \leq 90^o : CosZ = A - B$; $Yo + Yp \geq 90^o : CosZ = B - A$

$X \geq 90^o = 180^o$ { $Yo + Yp \leq 90^o : CosZ = A + B$; $Yo + Yp \geq 90^o : CosZ = A + B$

POINTS SAME SIDE OF EQUATOR:

$X \leq 90^o : CosZ = A + B$
$X \geq 90^o : CosZ = A - B$

Note: Each of the above values for CosZ yield two possible angles which sum to 180°. The following rule applies in determining which angle is required.

POINTS OPPOSITE SIDE OF EQUATOR:

Yo + Yp $\leq$ 90°:
Z is lesser value for X $\leq$ 90°
Yo + Yp $\geq$ 90° $\leq$ 180°:
Z is greater value for X $\leq$ 90°
Yo + Yp $\leq$ 90°:
Z is greater value for X $\geq$ 90° $\leq$ 180°
Yo + Yp $\geq$ 90° $\leq$ 180°:
Z is greater value for X $\geq$ 90° $\leq$ 180°

POINTS SAME SIDE OF EQUATOR

X $\leq$ 90° : Z is lesser value.
X $\geq$ 90° $\leq$ 180° : Z is greater value.

The distance to the relevant point is obtained from the value of Z in degrees and decimals of a degree by multiplying by 69,057 miles.

B. BEARING ANGLES

B. BEARING ANGLES: (B degrees)

For points opposite sides of equator:

$$\text{Tan } B = \frac{\text{Cos Yp Sin X}}{\text{Cos Yo Sin Yp} - \text{Sin Yo Cos Yp Cos X}}$$

For points same side of equator:

$$\text{Cot } B = \frac{\text{Sin Yp Cos X}}{\text{Sin Yo Cos Yp} - \text{Cos Yo Sin Yp Sin X}}$$

Should you get bogged down, the new RSGB Handbook contains some similar formulae which may prove simpler to use.

RADIO ZS

Silent Key

E. P. ROSEWARNE, ZS6WI

It is with deep regret that we have to tell our listeners that Ted Rosewarne, ZS6 William Ida, passed away in the early hours of Tuesday, September 1st, 1970.

Ted had recently fought his way back to health from a long and very painful spinal ailment, only to be taken ill again on August 30th. He had been a ham for over thirty years and was a long standing member of the Johannesburg branch. Over the years he had been an active committee man, a popular lecturer at branch meetings and for a number of years he compiled and read the branch bulletins. He did much good work on the B.C.I. committee and contributed many excellent articles to Radio ZS, his last being a splendid description of a novel S.S.B. transmitter he had designed and built. He was also a staunch member of the World Association of Methodist Radio Amateur Clubs, popularly known as WAMRAC.

But Ted was best known and loved as Chairman of the Early Morning Gang, a post he had held for some twenty years. Always bright and optimistic with a cheery word for all his many listeners and ever the soul of tact and courtesy. He will be sadly missed in many homes throughout South Africa and beyond.

To his Mother and sister Margaret, and to all those who mourn the passing of a great gentleman, we extend our deep sympathy and condolences.

ZS6HR

WATCH THAT CURRENT

submitted by M. W. Newman, ZS6-398

Taken from Radio Society of Rhodesia Magazine CQU CADS, 1961.

A reminder about the dangers of electrocution in the shack, we feel, is never out of place, but don't close down the station after reading this article reprinted from "QST".

Which is more lethal, 10 000 Volts or 100 Volts? The answer is:— the voltage which sends the greater current through the body.

Unlikely as it may sound, any current over 10 milli-amps can produce severe shock, while current of 100 ma to 200 ma are fatal. Above 200 ma severe burns and unconsciousness results, but death is avoidable if immediate attention is given to the victim.

This is what happens to the human body as current increases:—

Below 10 ma a mild sensation is felt. Between 10 and 20 ma pain increases and grip of a live conductor cannot be released. At 20 ma muscular paralysis starts. At 30 ma severe shock is experienced. At 50 ma breathing is upset and becomes laboured. At 75 ma extreme breathing difficulties are felt. Between 100 and 200 ma . . . DEATH! Above 200 ma very severe burns are caused and breathing stops.

The apparent contradiction, viz., that currents above 200 ma are not as dangerous as those between 100 and 200 ma can be explained as follows:—

As the current approaches 100 ma uncontrolled twitching of the heart muscles, known as "ventricular fibrillation" starts and there is no hope for the victim. Above 200 ma the muscles contract so severely that the heart is forcibly clamped and protected from going into fibrillation. The victim stands a fair chance of survival. This also explains why victims of high-voltage shock, respond more readily to artificial respiration.

So take heed — 75 Volts are just as dangerous as 750! Body resistance varies from about 100 ohms between the ears to 500 ohms from hand to foot. These are internal resistances and do not include skin resistance, which may vary from 1 000 ohms for wet skin to $\frac{1}{2}$ megohm for dry skin.

Safety Precautions:—

1. Cut off power before touching any wiring and make sure **nobody** can switch on accidentally.
2. Keep one hand in your pocket if you must investigate live electrical equipment.
3. Move slowly — place feet firmly for good balance — do not try to grab falling tools.
4. Don't work on live equipment in cramped quarters and make sure equipment is grounded before starting work.
5. Most important — don't touch electrical equipment while standing on damp concrete or any well grounded surface.

In an Emergency:—

1. Cut voltage or remove victim from contact as soon as possible, using a length of dry wood, rope or blanket to pry or pull victim loose. DON'T waste time looking for the power switch if this is not immediately at hand.
2. If the victim is unconscious, give artificial respiration without delay and don't stop till the victim revives or until a doctor pronounces the victim beyond help.

QSY Page 24

How to Handle Hi-Fi Interference

A Cautious Approach To A Sticky Problem

With acknowledgements to QST

by Lewis G. McGoy, WIICP

It is very apparent from our mail that while TVI has become less and less a problem, amateur interference to hi-fi, tape recorders, electronic organs and such types of entertainment equipment has been getting worse. It is also apparent that most of the problems are on the increase because of the gradual changeover to the use of solid-state circuits in these devices. While it is possible to have interference problems with vacuum-tube units, solid-state equipment is much more susceptible to interference from nearby rf fields. The simple fact of the matter is that solid-state units are more inclined to overload than tube devices.

Let's make one important point clear before going into greater detail; there is *nothing* a ham can do at his own station to eliminate the majority of these types of interference. True, he can go off the air, but that is not the answer to the problem. We are continually getting queries asking how a ham can debug or fix his station so it won't interfere with such devices. Possibly the only type of interference that could be the ham's fault might be a harmonic that would interfere in the fm spectrum, 88 to 108 MHz; however we are assuming the ham station has no parasitic or harmonic emission.

What's The Reason?

The question asked by any amateur who doesn't understand the problem, would be why his transmitter signal could cause interference to a device that has no frequency relationship to his signal. For example, a record player isn't even a radio receiver, it is simply an audio amplifier that amplifies audio signals. Nevertheless, such a device can be easily interfered with by a nearby ham radio station, through no fault of the amateur. When such pieces of equipment are operated in the presence of a strong rf field, the energy can be coupled or fed into the device, causing interference. The rf is rectified in the units and ultimately appears as audio, in one form or another, at the speakers.

An unmodulated, unkeyed, radio signal can cause a hum in hi-fi equipment, or a reduction or increase in the audio level which may go unnoticed by the user. When the carrier is keyed, as in cw operation, the audio level will change in time with the keying rate. If the carrier is amplitude modulated, the amateur's voice can be heard in the audio equipment. In ssb operation the interference will take on the character of gibberish and would be unreadable to the audio listener. Also, fm would be unreadable. If the hi-fi listener didn't know there was a ham nearby he normally would be unable to identify the source of the interference. However, we have to get along with our neighbours and sooner or later the source of the interference will be identified — meaning *you,* the ham.

The Public Relation Problem

Before getting into details for curing such interference, let's discuss an even more important phase of the problem — public relations. Having gone through all the troubles with TVI, amateurs should be well aware of the problem of dealing with an uneducated public. Most of the successful approaches that were used with TVI and public relations problems can be used effectively with audio equipment interference.

For one thing, never start off by telling a hi-fi owner that you know your gear is OK and that his equipment is at ☛

fault. *You* may know that is the truth, but just for a moment, put yourself in the other guy's place. You've just paid "umpteen" dollars for a real classy 8-channel, multiple-speaker, high-fidelity installation and some one comes along and makes the speakers jump off the wall with interference. How would you feel? Not very good, and that's for sure. Your first step would be to call the dealer where you bought the unit and ask what was wrong. The dealer would send a repairman out, who, after checking the unit, would probably say it was the ham's fault and that there was nothing wrong with the hi-fi unit. (Unfortunately, while the serviceman may know how to repair such gear they seem to be completely inept when it comes to the simple steps of eliminating rf interference).

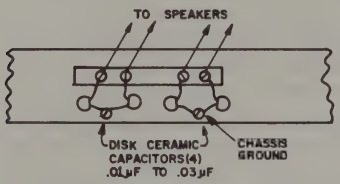


Fig. 1 — The disk capacitors should be mounted directly between the speaker terminals and chassis ground, keeping the leads as short as possible.

Your problem is now one of educating an irate hi-fi owner who has been told that his equipment is OK while your rig is at fault — and when you know for a fact that the opposite is true! We could hardly fault a ham for feeling a little irked about such a situation but believe us, nothing but trouble will result if you can't handle the situation with tact and diplomacy. As they say, this is the time to "keep your cool".

A good approach is to tell the hi-fi owner that you will be happy to talk to the dealer and serviceman to see what can be done about the interference. Once you get to the serviceman, you can point out the simple steps needed to clean up the interference. We can assume that the serviceman has some knowledge of electronics and can understand lead filtering and bypassing. This approach to the problem will work in many instances. However, you'll occasionally run into a dealer who isn't co-operative. In such cases, the only answer is to write directly to the manufacturer and point out the problems, including the lack of co-operation on the part of the dealer.

As an example, a ham from Milwaukee had a neighbour who purchased an organ, of well-known make. When operating on 20 meters, the W9 had audio interference in the organ (which was about a block away). The dealer informed the ham that nothing could be done at the organ to cure the trouble and even implied the cause was at the transmitter. The amateur wrote directly to the organ manufacturer, even offering to install the necessary corrective measures himself. The manufacturer answered very quickly and assured the ham that the organ was at fault and enclosed the required information for correcting the problem. Additionally, the manufacturer straightened out the dealer about the causes and cures.

We have heard of many such examples, so it does pay to write to the manufacturer about a particular problem. Most important — enough so to keep repeating ourselves — the answer in handling all complaints is to use tact. Probably the utmost in tact was displayed by a ham who was blamed for interference that was actually caused by three CB stations. The ham stepped in and cured the interference and in the meantime made a ham out of one of the CBers and the hi-fi owner! That's not only tact — that's salesmanship.

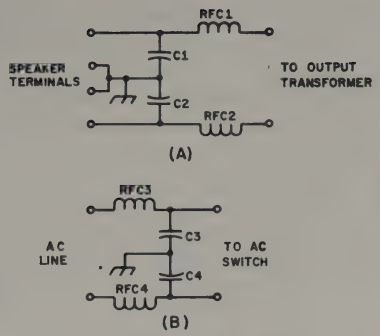


Fig. 2 — At A, the method for additional speaker filtering, and at B, filtering the ac-line input. In both cases, these installations should be made directly inside the amplifier chassis, keeping the leads as short as possible.
C1,C2 — .01-to .03-uF disk ceramic.
C3,C4 — .01 disk ceramic, ac type.
RFC1 through RFC4 — 24 turns No. 18 enamel covered wire, close-spaced and wound on a 1/4-inch diameter form (such as a pencil).

The Cures

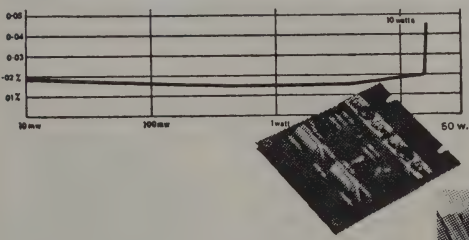
Step number one is to try and determine how the interference is getting into the hi-fi unit. If the volume control has no effect on the level of interference or very slight effect, the audio rectification of the amateur signal is taking place past the volume control, or on the output end of the amplifier. This is by far the most common type. It usually means that the amateur signal is being picked up on the speaker leads, or possibly on the ac line, and is then being fed back into the amplifier.

In our experience, and we are not talking about radio or TV, most of the rf gets into the audio system via the speaker leads or the ac line, mostly the speaker leads. You may find that on testing, the interference will only show up on one or two bands, or all of them. In hi-fi installations speakers are sometimes set up quite some distance from

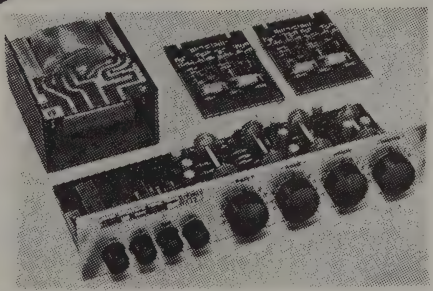
SINCLAIR EQUIPMENT

APPLICATIONS

High fidelity amplifier: car radio amplifier: record player fed direct from pick-up: intercom: electronic music and instruments: P.A., laboratory work. etc. Full details of these and many other applications are given in the manual supplied with your Z.30.



Z12 Amplifier	R12
Z30 Amplifier	R18
Stereo 25 Control Units	R30
Stereo 60 Control Units	R36
PZ4 Powerpack	R15
PZ5 Powerpack	R18
PZ6 Powerpack	R22



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the amplifier. If the speaker leads just happen to be the same length as one of your transmitting antennas, you've got troubles. The speaker lead will act as a resonant antenna and pick up the rf. One easy cure to try is to bypass the speaker terminals at the amplifier chassis. Use .01 to .03-uF disk capacitors from the speaker terminals directly to chassis ground, see *Fig 1.* You can try .01-uF and see if that does the job. We found in some amplifiers that .03-uF were required to eliminate the rf. Be sure to install bypasses on *all* the speaker terminals. In some instances, it may appear that one of each of the individual speaker terminals are grounded to the chassis. However, some amplifiers have the speaker leads above the ground on the low side, for feedback purposes. If you have a circuit diagram of the amplifier you can check, but in the absence of a diagram bypass all the terminals. If you can get into the amplifier, you can use the system shown in *Fig. 2A,* a method recommended by the Electro-Voice Corp.

In this system, two rf chokes are installed in series with the speaker leads from the output transformers, or amplifier output, to the speakers. These chokes are simple to make and help keep rf out of the amplifier. In particularly stubborn cases, shielded wire can be used for the speaker leads, grounding the shields at the amplifier chassis, and still using the bypasses on the terminals. Speaking of grounding, all chassis used in the hi-fi installation should be bonded together and connected to a good earth ground (such as a water pipe) if at all possible. In our experience, we have found that grounding sometimes eliminates the interference. On the other hand, don't be discouraged if grounding doesn't appear to help. Even with the bypassing and filtering grounding may make the difference.

Fig. 2B shows the method for filtering the ac line at the input of the amplifier chassis. The choke dimensions are the same as those given in *Fig. 2A.* Be sure that the bypasses are rated for ac because the dc types have been known to short out.

Fig. 3 shows the method for lead filtering the input circuits of an amplifier, such as the record-player input. Keep all leads as short as possible to reduce the possibility of rf pickup.

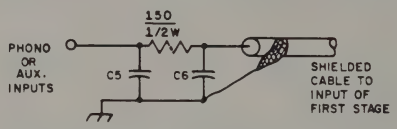

Fig. 3 — Method for filtering phono or auxiliary input leads. The filter circuit should be mounted directly inside the chassis at the terminal. Use short leads, wherever possible.
C5,C6 — 150-pF mica capacitors.

Antenna Pickup

If the hi-fi setup includes an fm installation, and many of them do, there is the possibility of rf getting into the audio equipment by way of the fm antenna. Chances for this method of entry are very good and precautions should be taken here to prevent the rf from getting to the equipment. A TV-type high-pass filter can prove effective in some cases.

For the benefit of the Novices, a high-pass filter is simply an electrical circuit, usually enclosed in a small shielded metal container, that will attenuate all radio frequencies below the filter's designed cut-off frequency. High-pass filters are usually designed with a cut-off frequency of about 40 Mhz. The filter will pass any radio signal higher than its designed cut-off frequency, but will attenuate any frequencies below the cut-off frequency. The filter can be installed directly at the chassis near the fm antenna terminals. Directions that come with these filters are for television sets but the same installation

techniques can be followed for the fm sets.

HAMTOON by D.E.R. Londt

Conclusions

We don't suggest that the amateur needs to install these preventive devices on a neighbour's hi-fi installation. The problem in doing such installations yourself is that the hi-fi owner would be inclined to blame you if something went wrong. However, as pointed out earlier, *knowing* how to do the job will enable you to do the job will enable you to deal with the hi-fi dealer or his serviceman.

In particularly stubborn cases, it is a good idea to write to the manufacturer of the equipment and see what recommendations he may have. And, above all, use diplomacy and tact in dealing with *any* interference case, whether it is your fault or not. RADIO ZS

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continued from page 14

*ZS6UD	R. C. Jackson, P.O. Box 92, Bleskop. Dist. Rustenburg, Transvaal.
*ZS6UF	Mrs. Eileen Jackson, P.O. Box 92, Bleskop Dist., Rustenburg, Transvaal.
*ZS6WI	Ted Rosenware — Silent Key — Deceased.
*ZS6YK	Ray Primack, 144-8th Avenue, Highlands North, Johannesburg.
*ZS6ZK	P. le Grange Louw, — delete — see ZS1ZK
*ZS6ZL	D. P. Price, c/o P.O. Box 20273, Alkantrand, Pretoria.
*ZS6ZM	M. N. Zoellner, delete — see ZS5ZM

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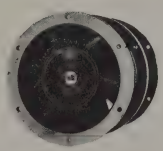

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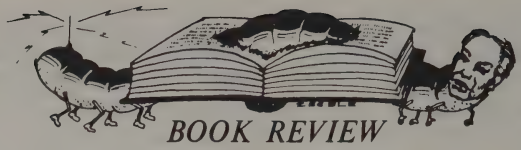

by Colin Duff ZS1CA

A.R.R.L. Radio Amateur's Handbook.

The Radio Amateur's Handbook for 1970 has again been extensively revised and updated by the Headquarters Staff of the American Radio Relay League.

As was true of the 46th edition, considerable revision has been made in both theory and construction sections of the Handbook. Emphasis has again been placed on practical state-of-the-art themes. New material has been added throughout the Book. The Portable/Mobile and the Antenna chapters have been completely re-written to reflect modern trends and practices. The semi-conductor tables have been greatly expanded to provide the latest transistor and diode specifications in simple reference form.

Numerous brand-new construction projects are included, amongst them are such items as universal-type power supplies for all voltage ranges from 3 – 3000 solid-state receivers and transmitters have been added, plus several new VHF and UHF converters and transmitters.

Two new linear amplifiers are described in the transmitting chapter, and new transmitting and receiving equipment has been added to the VHF/UHF chapters.

The new Handbook continues to fill the need for a standard textbook and reference work for both beginners and advanced amateurs. This edition contains 710 pages, including catalogue section and index. There are over 1300 illustrations, many of which have been revised, including 576 tube-base diagrams.

It is recommended as a worthwhile addition to your library, and in due course should be available from Headquarters or advertisers when stocks arrive.

RADIO ZS

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continued from page 18

3. It may take you up to eight hours to revive the patient. Even if the victim appears dead, remember that absence of a pulse and a condition similar to rigor mortis are symptoms of shock. Last, but not least, remember that familiarity breeds contempt, so bear in mind the simple precautions given above and you will be attending Society meetings for a long time to come.

RADIO ZS

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TAK NOORD-TRANSVAAL

Die C.Q. Hou Koers op die lug sal weer hierdie jaar gehou word op Saterdag 31 Oktober.

Aangesien ons hierdie jaar wil verbeter op die vorige jaar, wil ons graag soveel as moontlik van die Kommandoes op die lug hoor.

Die tyd sal hierdie jaar wees van 0600 tot 1800 uur.

Kennisgewing was deur middel van omsendbriewe oor al die verskillende Voortrekker Kommandoes gestuur.

Ons wil graag alle Radio Amateurs vriendelik vra om sover moontlik behulpsaam te wees om van hierdie dag 'n sukses te maak.

Toestemming is weer gevra om die stasie ZS6VTM by die Voortrekker Monument op te rig.

Beste 73,
ALBERT ZS6AXL
Sekretaris Tak Noord Transvaal

EAST RAND BRANCH NEWS

The Branch meeting held on the 12th August proved a big success. OM Jimmy, ZS6TQ, kicked off the refresher course on Amateur radio with a very instructive discussion of basic oscillators. He covered the "tickler", Hartley, Colpitts, and electron-coupled circuits, at a level calculated to please the old hands as well as the novice.

We were very sorry to hear that OM Sandy, ZS6QU, has been spending a good deal of time in the white house. Other reluctant visitors to that institution were the better halves of OM Jackie, ZS6007, and OM Stan, ZS6BJB. A speedy recovery is wished to all.

OM Mike, ZS6AFG, has been active on 2m, conducting tests with OM George, ZS6ADX, in Benoni, who puts out a good signal but was having trouble on the receiving side.

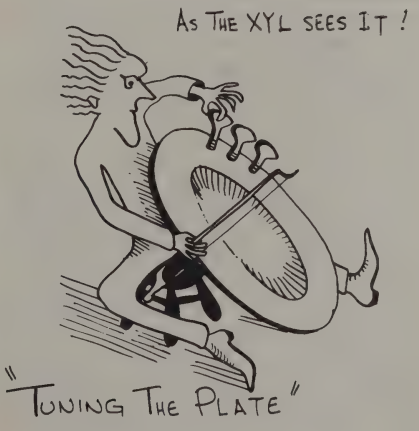
OM Lawrence, ZS6BBU, is constructing a solid-state SSB exciter. The work done so far looks very professional.

OM Dennis, ZS6AWN, has a new linear and is busy burning up the DX. A newcomer to the bands is OM C. J. Englebrecht, ZS6CT, formerly ZS6011. Congratulations on getting the "ticket", OM! OM Bernie, ZS6ACK, has struggled up to 184 countries worked with 144 confirmed.

We hear that OM Mike, ZS6MY, having aquired a FTdx100 was dismayed to find it did not fit under the dash of his car. There was only one thing to do — he promptly bought a larger car!

RADIO ZS

HAMTOON by D.E.R. Londt



RADIO OPERATOR'S CERTIFICATE EXAMINATION:

We are indebted to the Postmaster General's department for the following information in regard to the last examination for the Radio Amateur Operator's Certificate which was held on the 14th May, 1970. The information is given exactly as received though we were unable to reconcile the figures of the percentage failures with the percentage passes.

Total entries	40
Number of candidates	33
Percentage passed	75%
Percentage failed	43%
Highest percentage mark	94.3%
Lowest percentage mark	8.3%

The candidate who scored 94.3% is certainly to be congratulated on his or was it her, showing, and is sure to be a credit to Amateur Radio when operating on the air.

Our sympathy goes to those who failed and our best wishes for future success. We hope that they will not be downhearted but will put in some more study and make sure of passing when they try again.

The paper appeared to be a fair and reasonable one to the writer. It was interesting to see that the compulsory question, Number 3, was on telephony and required a knowledge of SSB.

CALL SIGNS:

We have been asked by the Postmaster General's office to bring to the notice of our members and Radio Amateurs in general that due to the difficulty which has been experienced in dealing with requests for changes in call-signs it will not be possible in future to entertain any requests for a change in call-sign, other than when necessitated by a move from one Division to another. The only exceptions may be in cases where phonetic difficulties arise in a particular combination of figures and letters.

BRANCH COMMITTEES:

This week we have to record the election of new committees by five of our branches. They are as follows:

Cape Town Branch:

Chairman:	Ray Alexander, ZS1IM
Vice-Chairman:	John Lotriet, ZS1JF
Secretary/Treasurer:	Jack Meerburg, ZS1FM
Members:	Ted Baker, ZS1RA
	Reg Baker, ZS1-021
	Clyde Hyman, ZS1CS
	Robert Jung, ZS1RR
	John Hugo, ZS1SC

Southern Transvaal Branch:

Chairman:	Hennie Potgieter, ZS6PO
Hon. Sec./ Treasurer:	Hub Paquay, ZS4PO
Members:	Barrie Badenhorst, ZS4RI
	Herman van Dyk, ZS6AUD
	Bobby Steytler, ZS6ATM

The address remains:
P.O. Box 959, Vanderbyl Park.

Durban Branch:

Chairman:	A. Hemsley, ZS5D
Vice-Chairman:	L. de Bruin, ZS5LP
Hon. Secretary:	Mrs. Muriel Niell, ZS5KG
Hon. Treasurer:	A. Niell, ZS5GK
Members:	G. Eastes, ZS5YT

	H. Comins, ZS5HC
	H. van Rees, ZS5CG
Editors CQ / Newsletter:	Albert and Muriel Niell
Auditor:	R. Gostelow, ZS5DV

Highveld Branch:

Chairman:	R. Barnes, ZS1AHB
Vice-Chairman:	D. Ansley, ZS6AJW
Hon. Treasurer:	J. Hulbert, ZS6ALX
Hon. Secretary:	K. Harwood, ZS6BLI
Editor Shacknews:	A. Kirkby, ZS6AKE

Pretoria Branch:

Chairman:	Doug Brook, ZS6AES
Vice-Chairman:	Brian Corlett, ZS6BLZ
Hon. Secretary:	Giel van Niekerk, ZS6NG
Hon. Treasurer:	Dick Chaplin, ZS6AJM
Co-Editors / Watts:	Doug Hutchinson, ZS6-225 / Steve de Wet, ZS6-226
Members:	Gerrit Erasmus, ZS6PA
	Bill Ingleson, ZS6KO
	Peter Whitworth, ZS6-229
	Chris de Souza, ZS6AVC
	Dennis Brown, ZS6EK
	Wessel du Preez, ZS6BLY

On behalf of our members we offer them our congratulations on their election and the faith which their members have in them and our sincere good wishes that they and their branches have a successful and happy year of office. We also thank them for their willingness to take office and to devote their energies to the good of their branches and our League. At the same time we wish to thank the retiring committees for the good work done during their term of office.

6 METRE BEACON:

We are pleased to report that the Highveld Branch have placed the 6 metre Beacon, ZS6VHF, into operation on a frequency of 50.1 MHz. The transmitter is the same one that was used previously, but the QTH has been changed to a position on top of the ridge to the North of Germiston at an elevation of 5800 feet above sea level. The antenna is a Ground Plane. Reports will be welcomed and should be sent to: Highveld Branch, P.O. Box 117, Edenvale, Transvaal.

PUBLICATIONS:

The following items are available to members from Headquarters office:

Great Circle Maps based on Cape Town — 60c each. Post 5c.
League Ties — R1.45 each. R1.50 per post.
Radio ZS covers — R1.60 each.
ZS Callbook covers — R1.20 each.
A.R.R.L. Handbooks — R4.20 per post.
A.R.R.L. VHF Handbooks — R2.30 per post.
A.R.R.L. SSB Handbooks — R2.30 per post.
R.S.G.B. Handbooks R6.00 per post.
R.S.G.B. Exam. Manuals at 55c per post.
World Callbooks, American Section — R5.75
World Callbooks, Foreign Section — R4.35

NEW AND RE-INSTATED MEMBERS:

We wish to welcome the following new and re-instated members to our ranks and hope they will be with us for many years.

G3MMJ	R, Browne, Associate.
	Dr. A. J. Richardson, East London Branch.
ZS2BP	Dr. J. B. Poulter, East London Branch.
ZS2CD	C. Rees, East London Branch.
ZS2HT	H. H. Short, East London Branch.
	A. C. Williams, Jo'burg Branch.
ZS6BHD	J. D. Freedman, Jo'burg Branch.
	Doreen West, Jo'burg Branch.
	M. R. Price, Jo'burg Branch.
ZS6-ASJ	John Geyer, Jo'burg Branch.
ZS6-303	P. W. Rabie, Jo'burg Branch.
ZS6-133	H. B. Joel, Jo'burg Branch.
ZS6LJ	E. Rottanburg, Jo'burg Branch.
ZS6-130	M. H. Cumin, Jo'burg Branch.
ZS6-129	Frank Haase, Jo'burg Branch.
ZS6-144	R. S. Wulfsohn, Jo'burg Branch.
ZS6-148	R. L. Joffee, Jo'burg Branch.
ZS6-150	J. R. Webb, Jo'burg Branch.
ZS6-193	R. J. Bird, Jo'burg Branch.
ZS6SJ	S. Georgi, Jo'burg Branch.
ZS6AGJ	F. Steynburg, Jo'burg Branch.
ZS6-136	L. R. Sourgen, Jo'burg Branch.
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ZS6-143	G. Ireland, Jo'burg Branch.

Hamads

P.O. BOX 137, CAPE TOWN – RATES: R0.50 for 20 words, 2 cents per word thereafter for members. Non-members and commercial smalls: R1.00 for 20 words, 4 cents per word thereafter. PLEASE SEND THE CORRECT AMOUNT WITH EVERY HAMAD OR SMALL.

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FOR SALE: Bandswitched, gang-tuned, C.W. transmitter, comprising oscillator, doubler stages, Eimac 4-65A final. Two automatically regulated power supplies, frequency meter, all in rack. Also loads of used and brand new components, 6 inch and 12 inch cathode ray tubes. R250 cash, the lot. The components in the rig alone are worth this. Stanley, P.O. Box 74, Evander, Transvaal. Phone 431.

WANTED: Collins KWM-2 accessories – VFO, Speaker, AC power supply, station control etc. Also Heathkit monitorscope and scanalyser.
Selling or swopping. Receivers (75S1), transmitters, ham & Test equipment, components etc. Send S.A.S.E. for list. ZS2PD, P.O. Box 1863, Port Elizabeth.

WANTED: Heath Kit Linear Amplifier. Recent Model. Good condition. State cash price. Contact P. J. Rabie, ZS1NP, "Sonja" Nuy, Dist. Worcester, C.P.

WANTED: One type 4/102 Geloso VFO, One type 4/104 Geloso VFO, Two Modulation Transformers similar to Type UM3. Reply to Noel H. Thomas, ZS5DU, 16 Union Street, Dundee, Natal.

DECEASED ESTATE: As new, Yaesu Musen FR 100B Ham Receiver 80 to 10 meters. To view at 98 Lancaster Avenue, Craighall Park, Johannesburg. Any reasonable offer will be accepted.

FOR SALE: Halicrafter SX 117 Receiver. Price R200 O.N.O. RME 6900 Receiver with matching Speaker R120 O.N.O. In mint condition. Contact Max Lapidus, ZS6BIN, P.O. Box 27192, Benrose, Transvaal. Phone Home: 90-3715 or Business: 24-9575.

FOR SALE: 100W AM Station, complete with SX28, Microphone, Key and 5 Band Vertical. R150. A2CAU, P.O. Box 120, Lobatse.

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ZS6-284	A. v.d. Weide, S. Tvl. Branch.
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ZS5JG	B. J. Killick, Pietermaritzburg Branch.
	A. R. Travers, Pietermaritzburg Branch.
ZS5AC	A. J. Conning, Pietermaritzburg Branch.
ZS6-304	B. L. Dreier, West Rand Branch.
	J. N. Bailey, Tak Boland.

Till next month,
73
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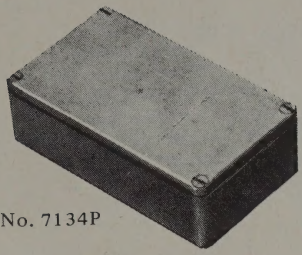

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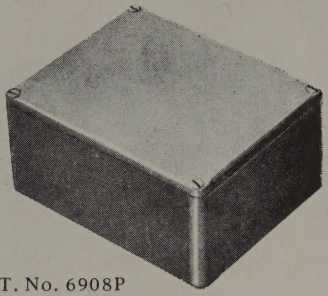

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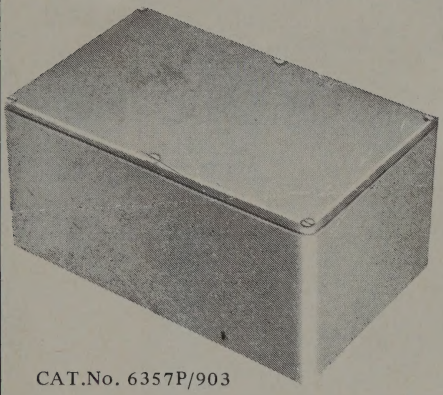

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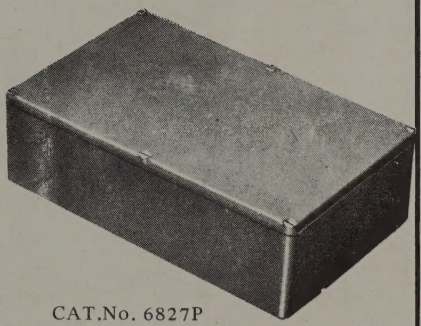

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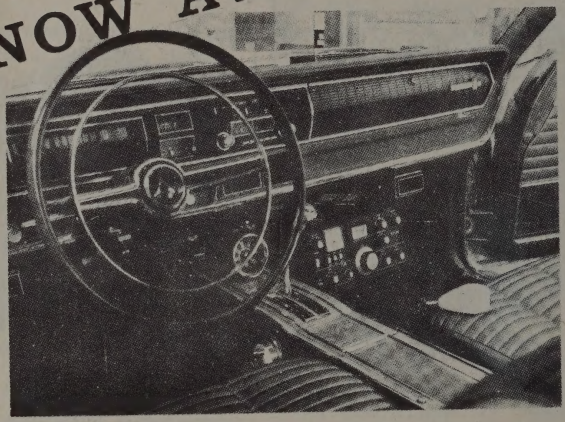

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Phones : 22-4441. 23-4496. 23-4294 P.O. BOX 10982

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